The Renal System

2 Kidneys

- Produces urine

2 Ureters

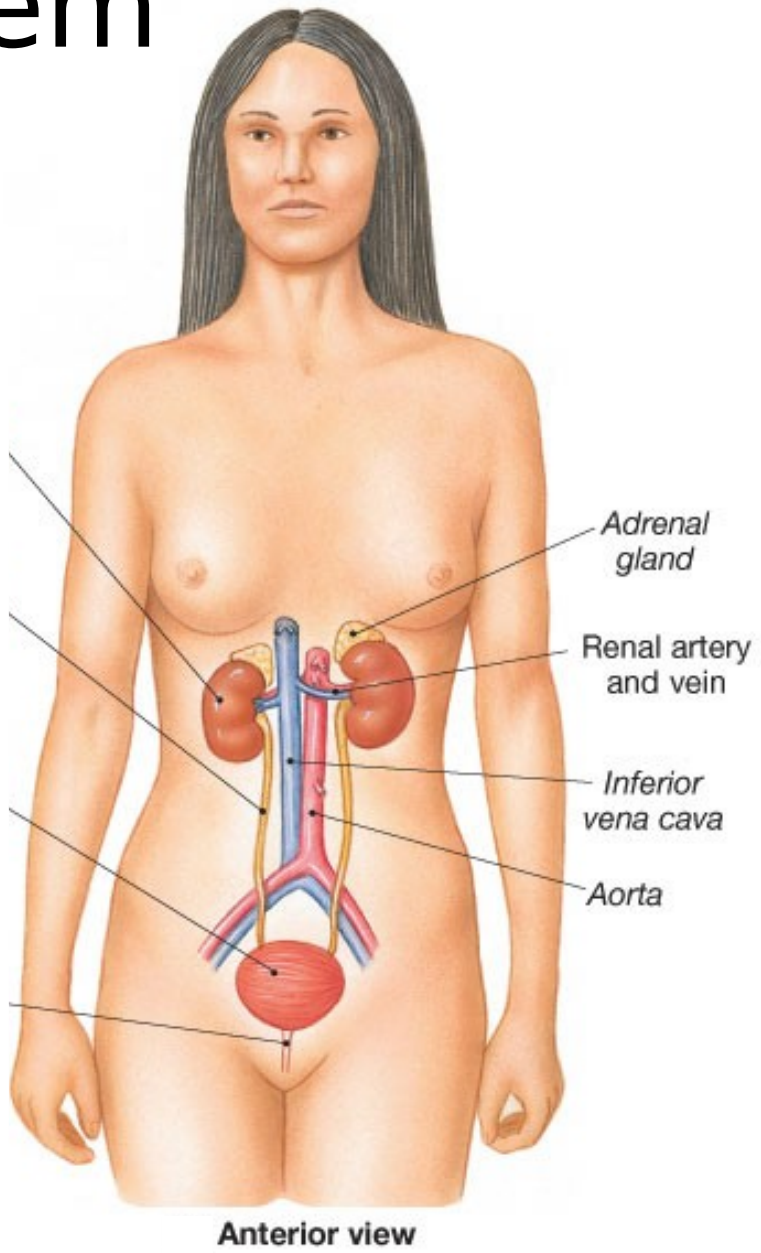
- transports urine

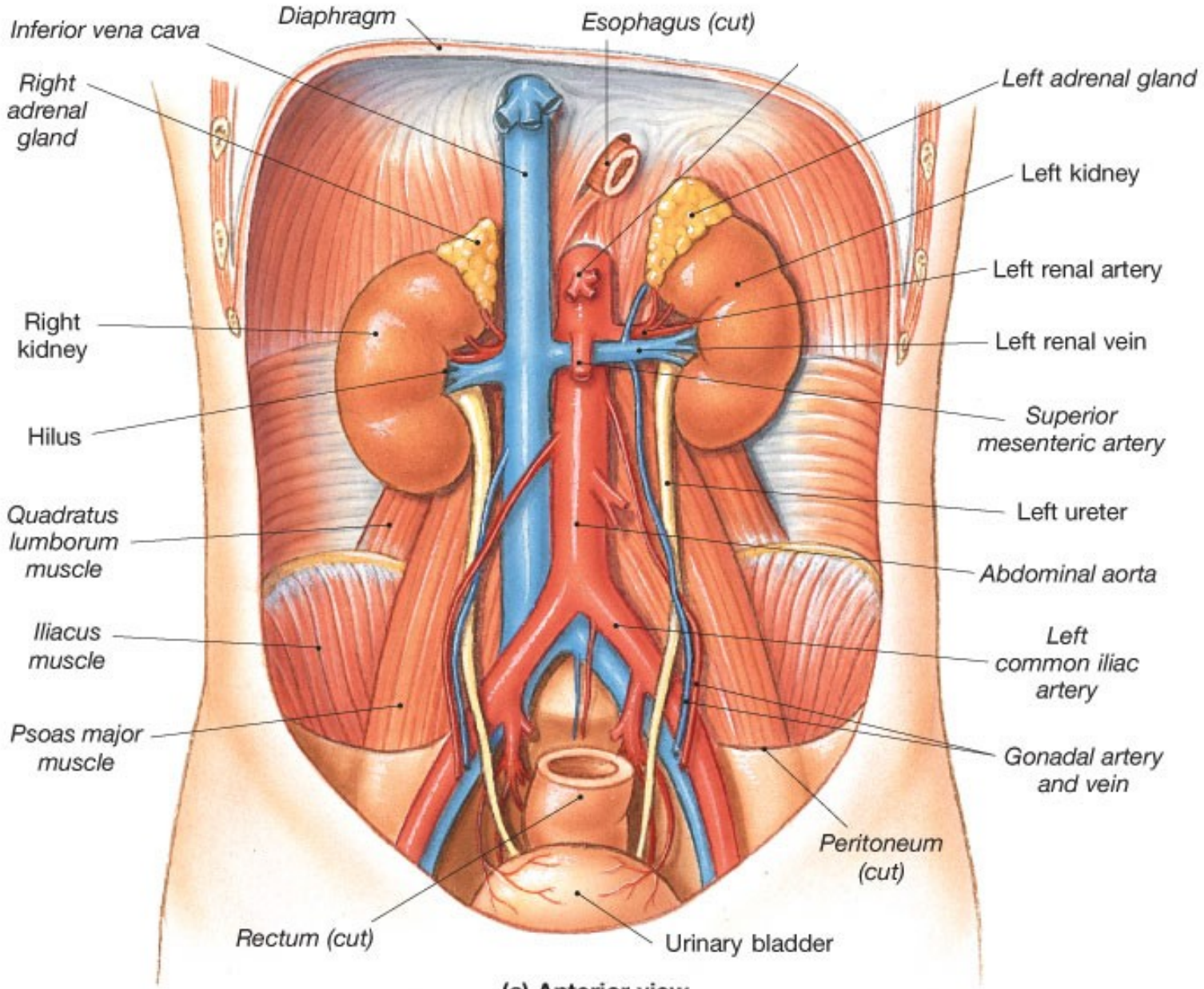
1 Urinary bladder

- stores urine

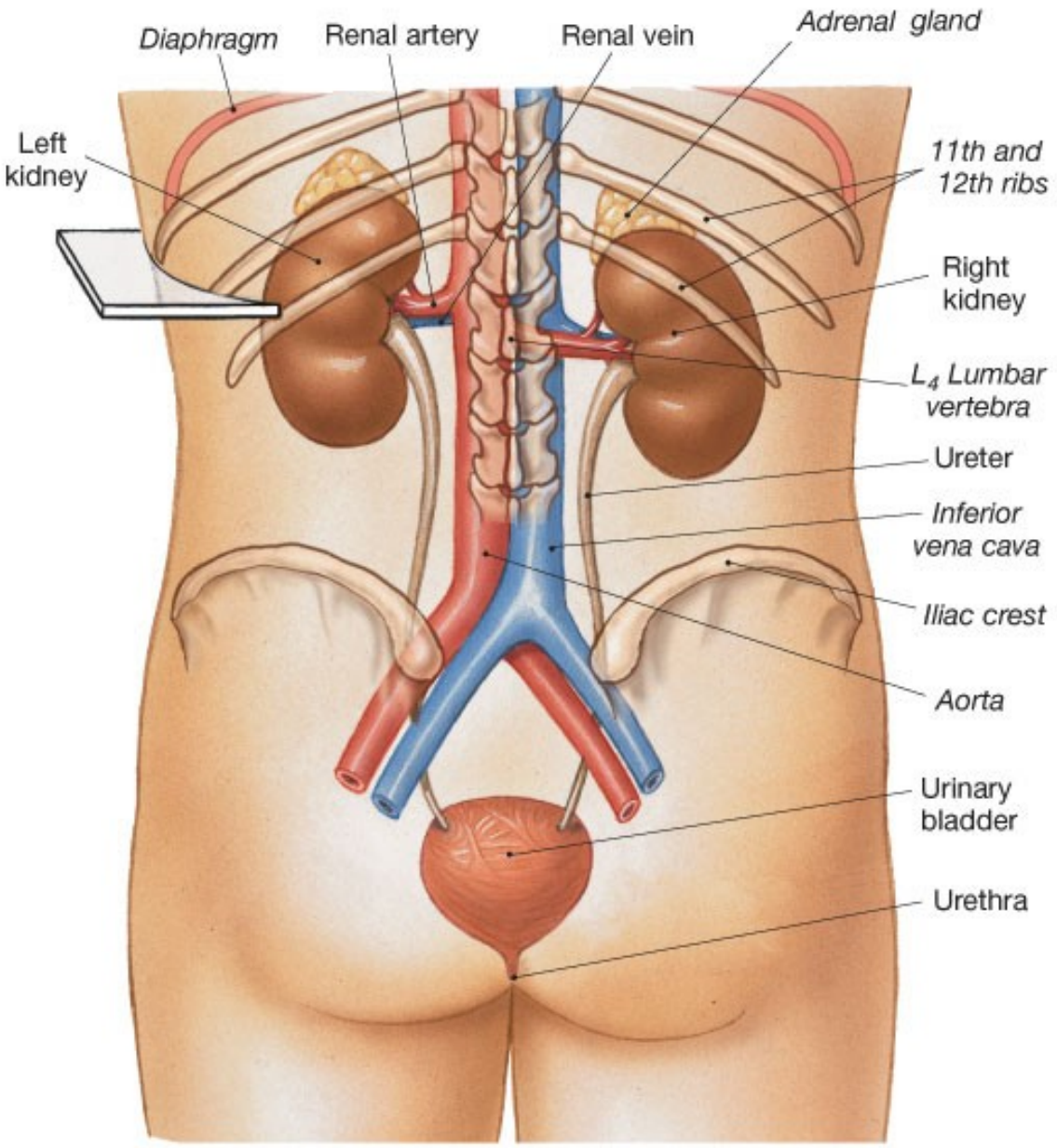
1 Urethra

- conducts urine to outside



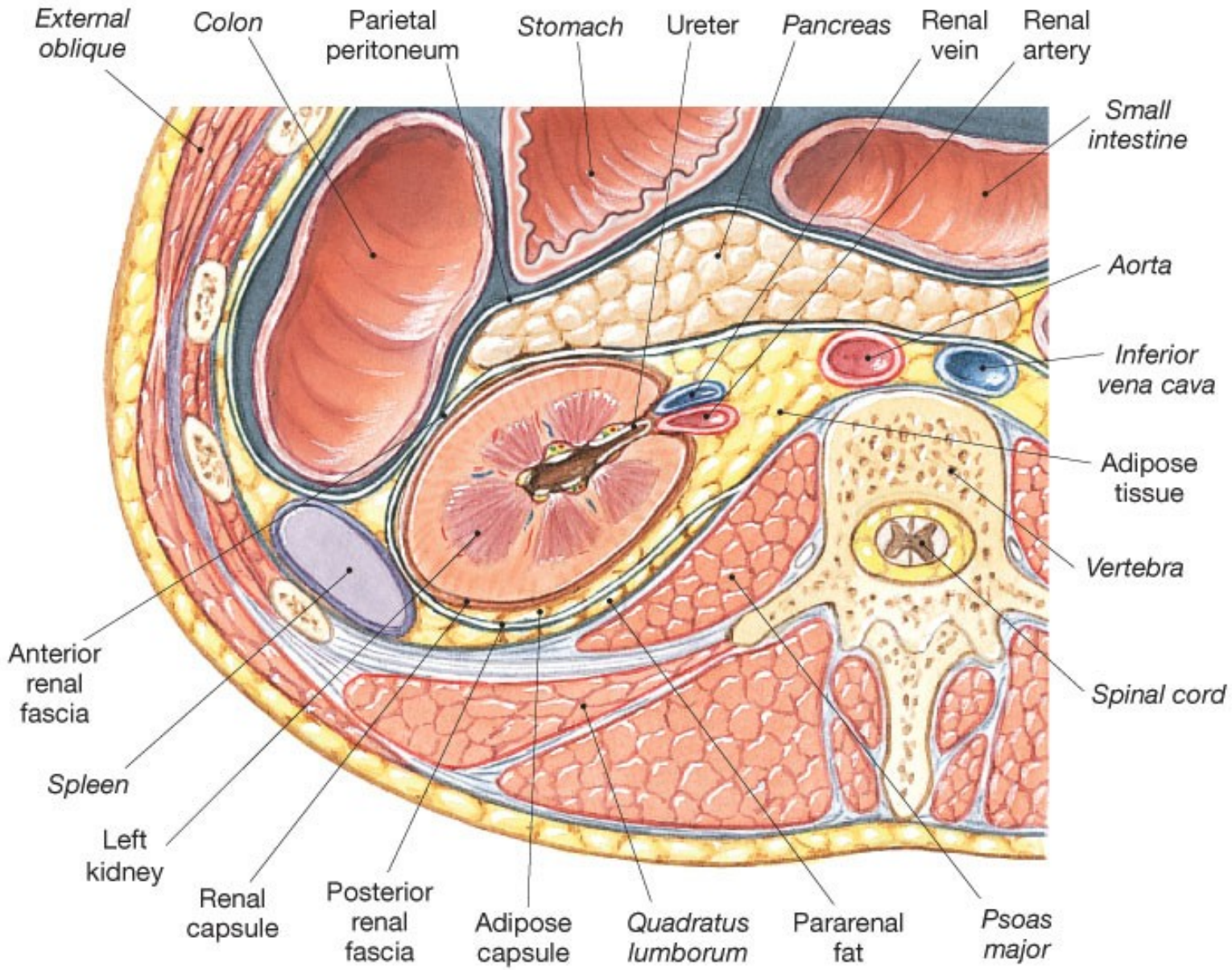


(a) Anterior view



(b) Posterior view

Transverse Section



3 Layers Surrounding the Kidney

Renal Capsule

- inner layer (outer surface of kidney)

Adipose Capsule

- fat padding around kidney

Renal Fascia

- outermost layer

Outer renal cortex

Inner renal medulla

Renal pyramid

Renal columns

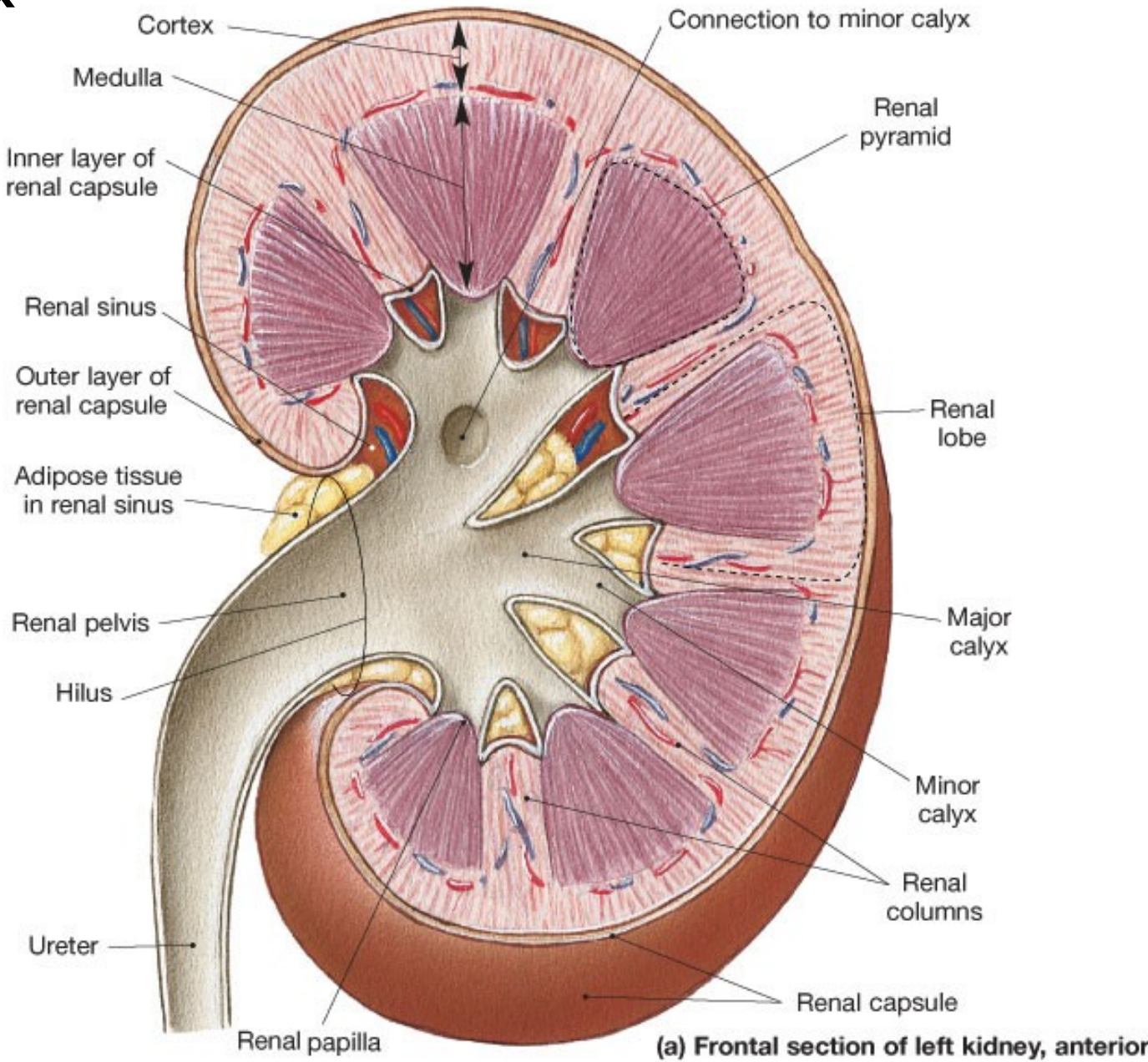
Renal papilla

Minor calyx

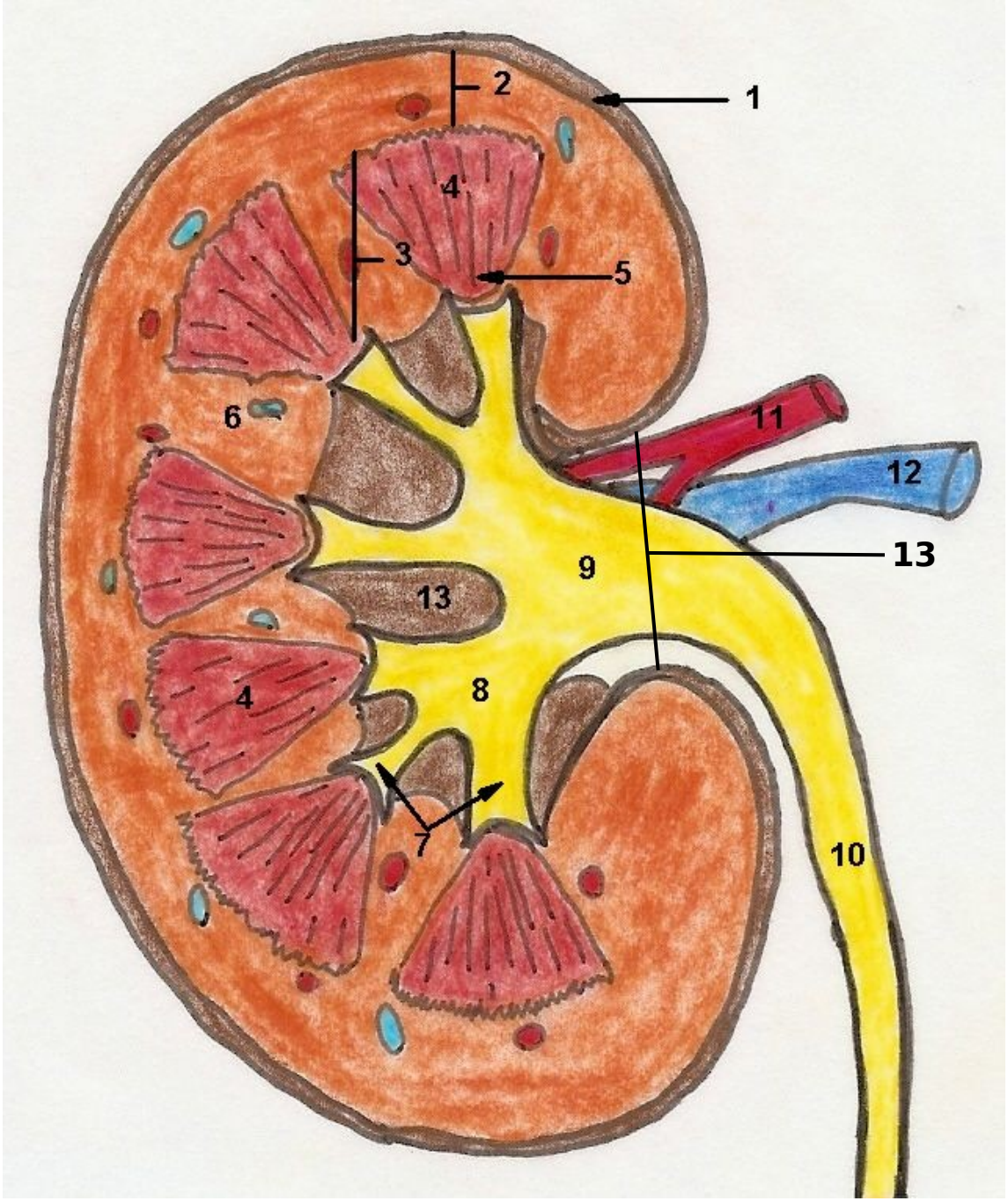
Major calyx

Renal pelvis

Ureter



(a) Frontal section of left kidney, anterior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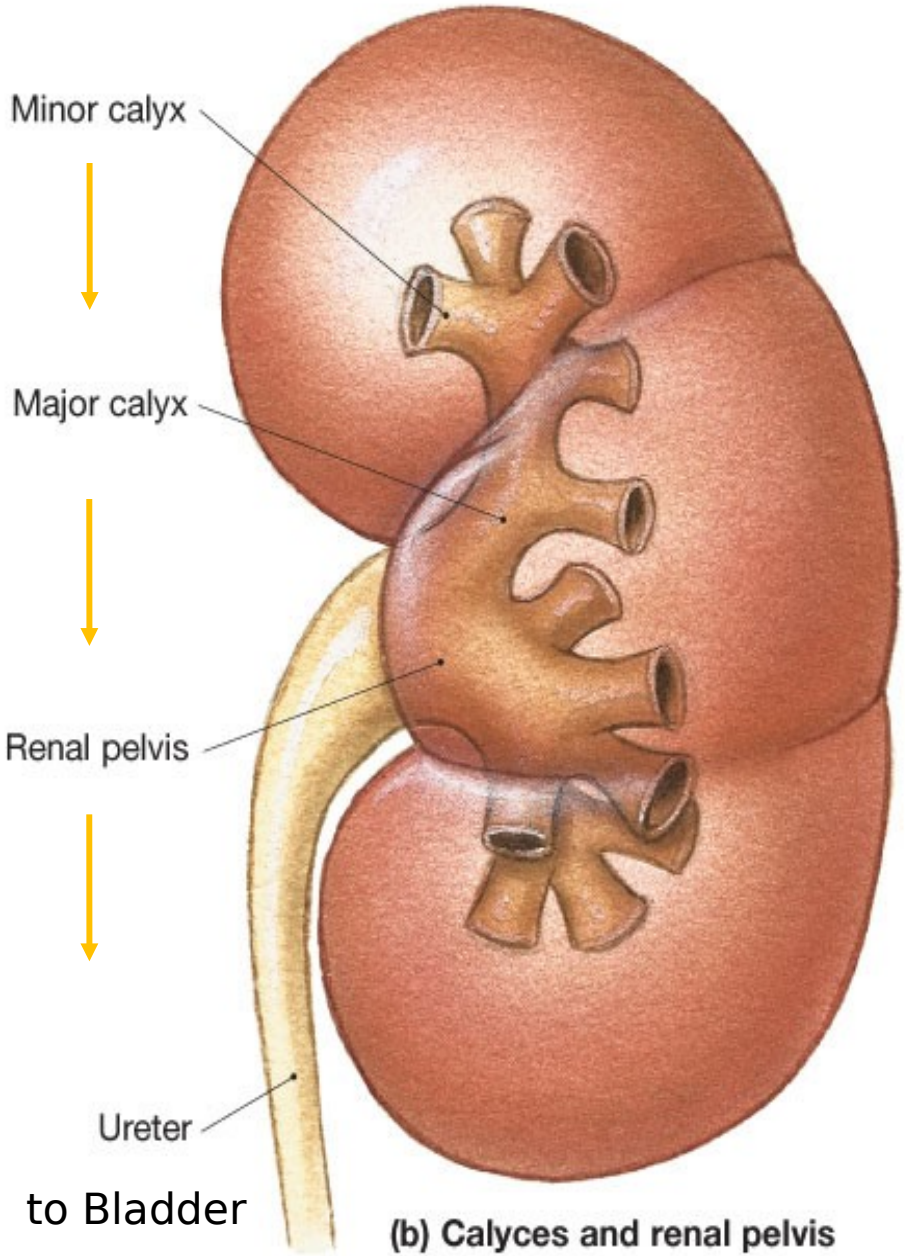
Collection of Urine in the Renal Systems

Calyx – ‘cup’

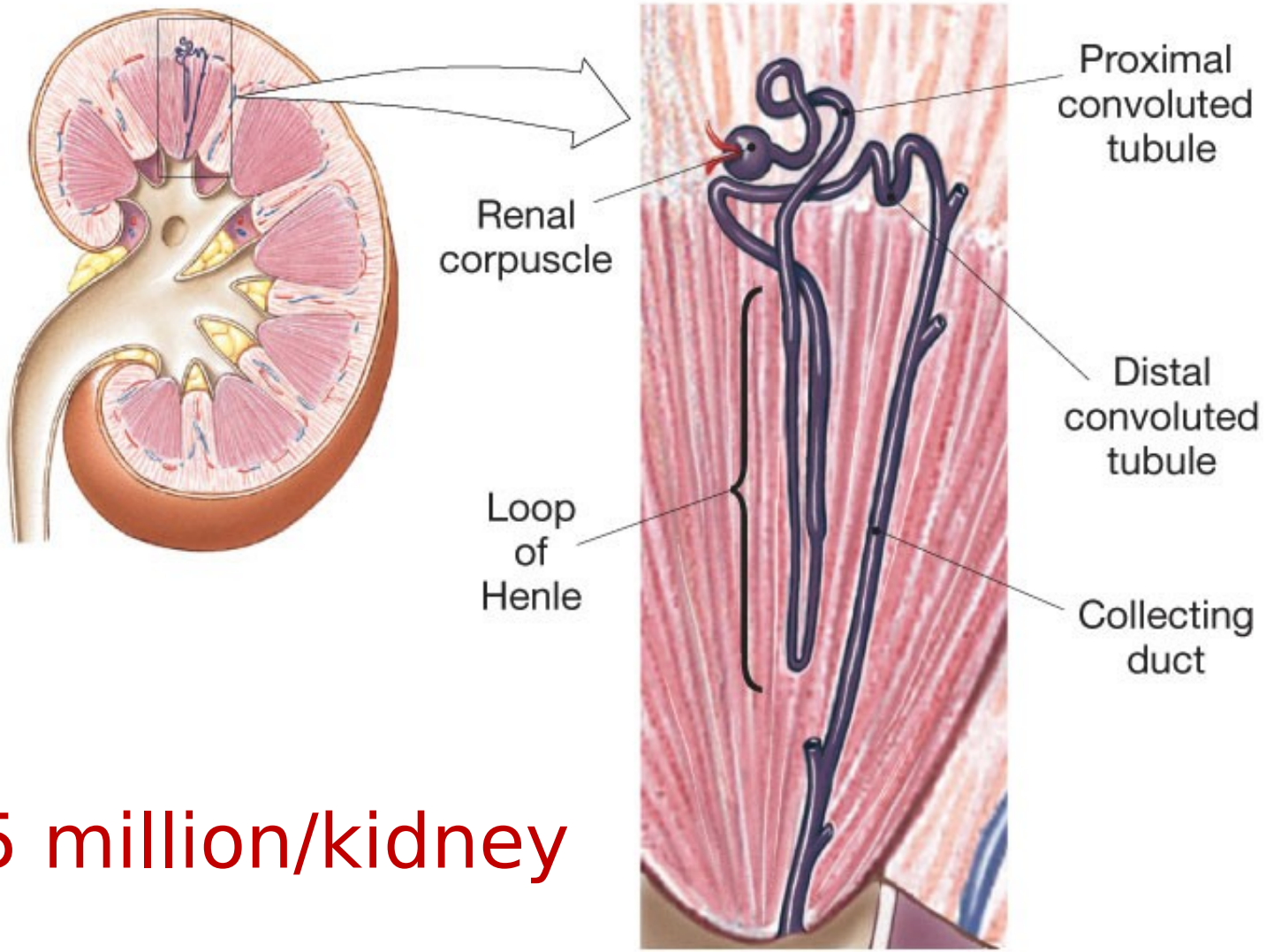
Pelvis = basin

Calyx - singular

Calicies - plural



The Nephron – Functional Unit



1.25 million/kidney

The Nephron has 2 parts:

1. Renal Corpuscle

a) Glomerulus

b) Bowman's Space

c) Bowman's Capsule

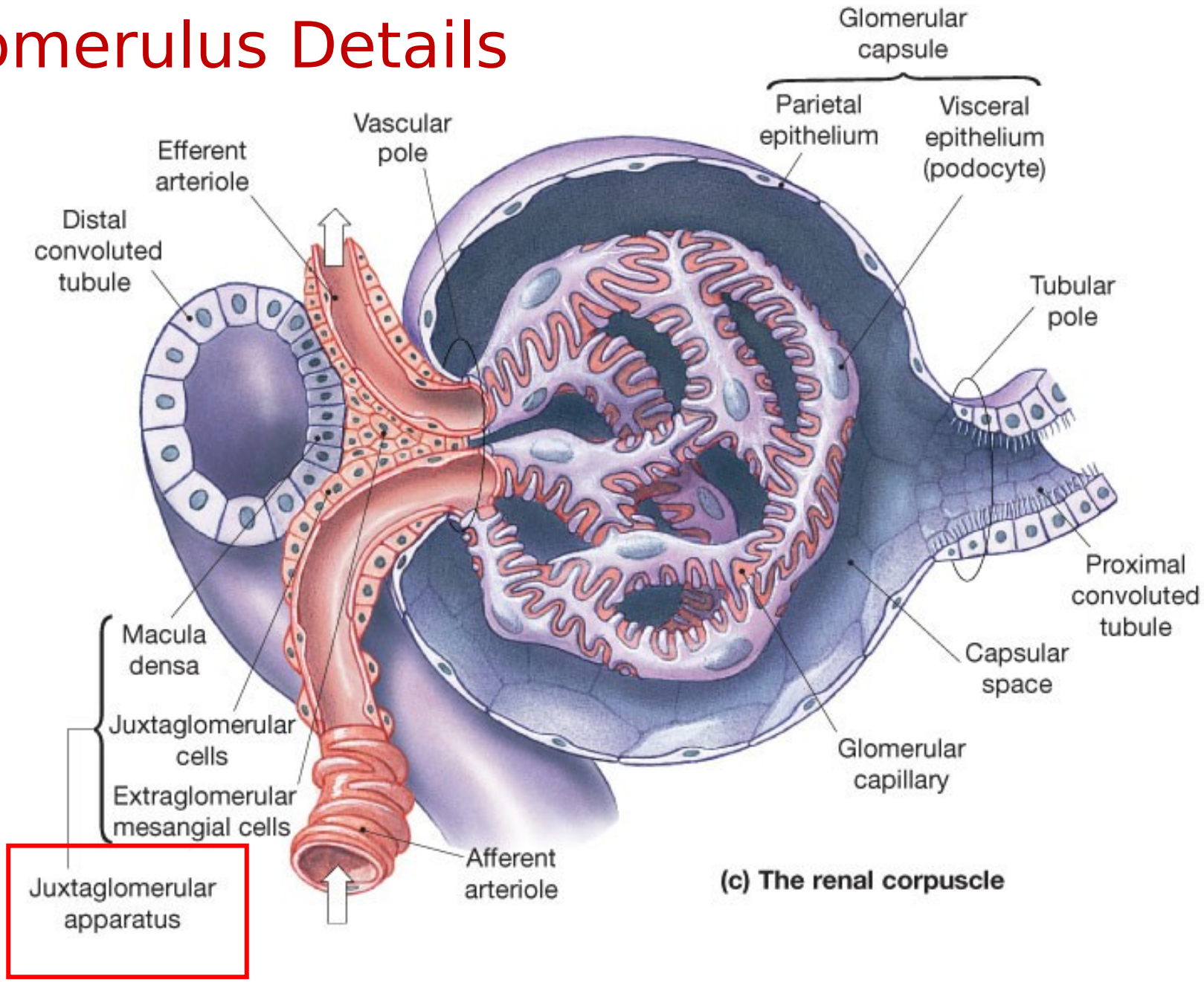
2. Renal Tubule

a) Proximal convoluted tubule (PCT)

b) Loop of Henle (nephron loop)

c) Distal convoluted tubule (DCT)

Glomerulus Details



Juxtaglomerular Apparatus

Macula Densa – specialized portion of DCT.

Sits in between afferent and efferent arteriole – for communication regarding renal function.

Juxtaglomerular (JG) Cells – specialized cells, mostly surrounding afferent arteriole.

For changing diameter of afferent arteriole.

~85% Cortical Nephrons

Short loop of Henle.

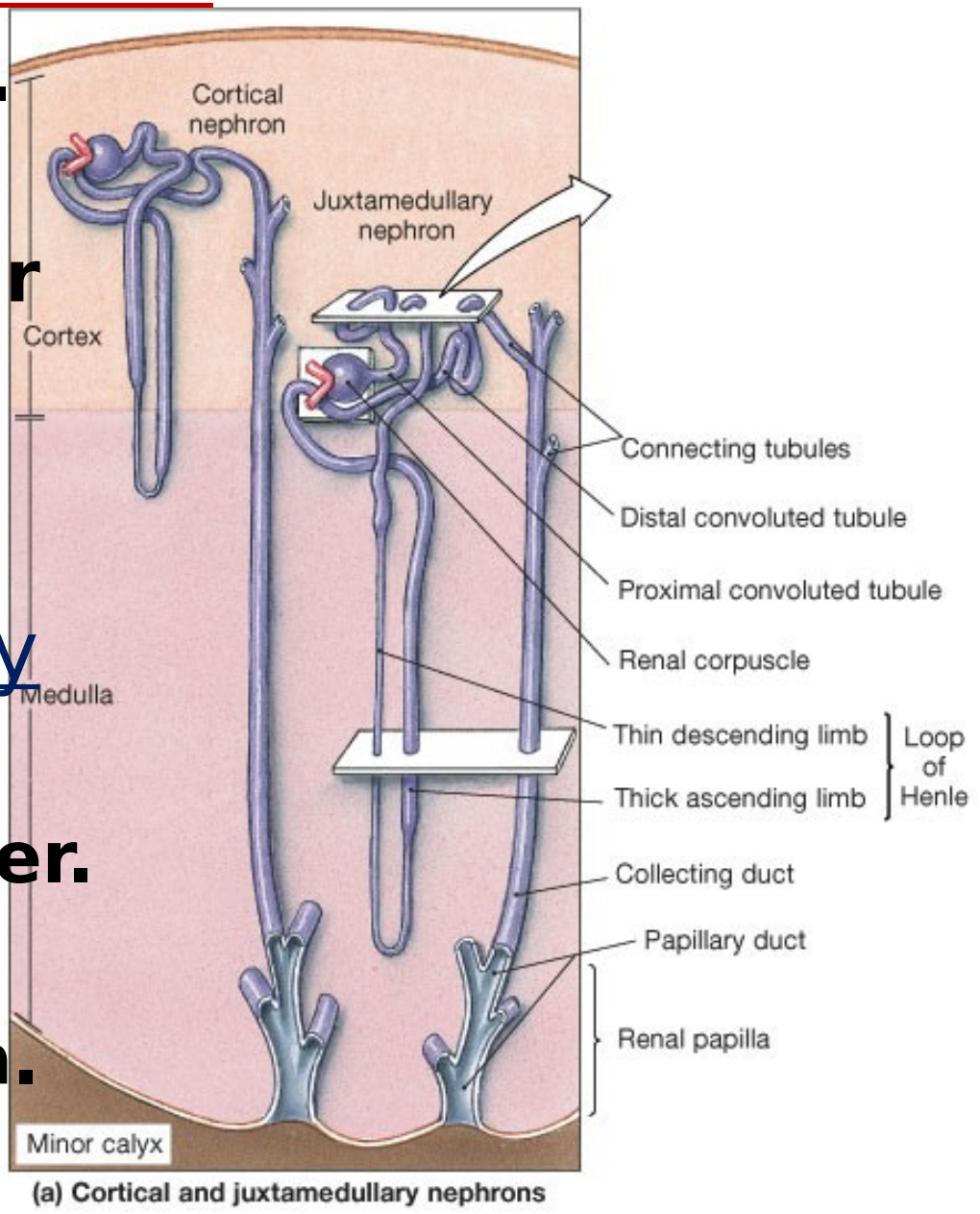
Efferent arteriole becomes peritubular capillaries.

15% Juxtamedullary

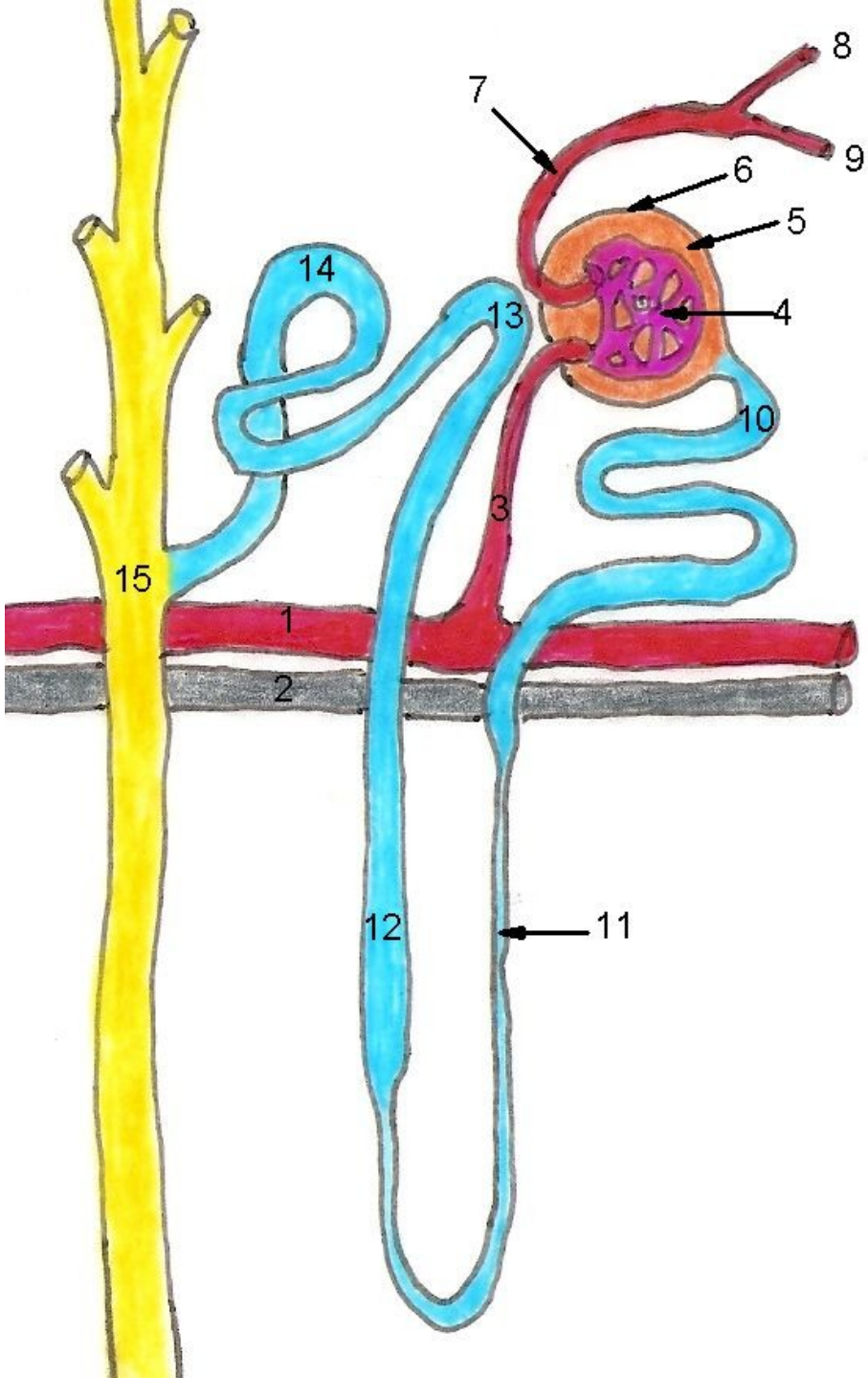
Closer to medulla.

Loop of Henle deeper.

Efferent arteriole becomes vasa recta.



(a) Cortical and juxtamedullary nephrons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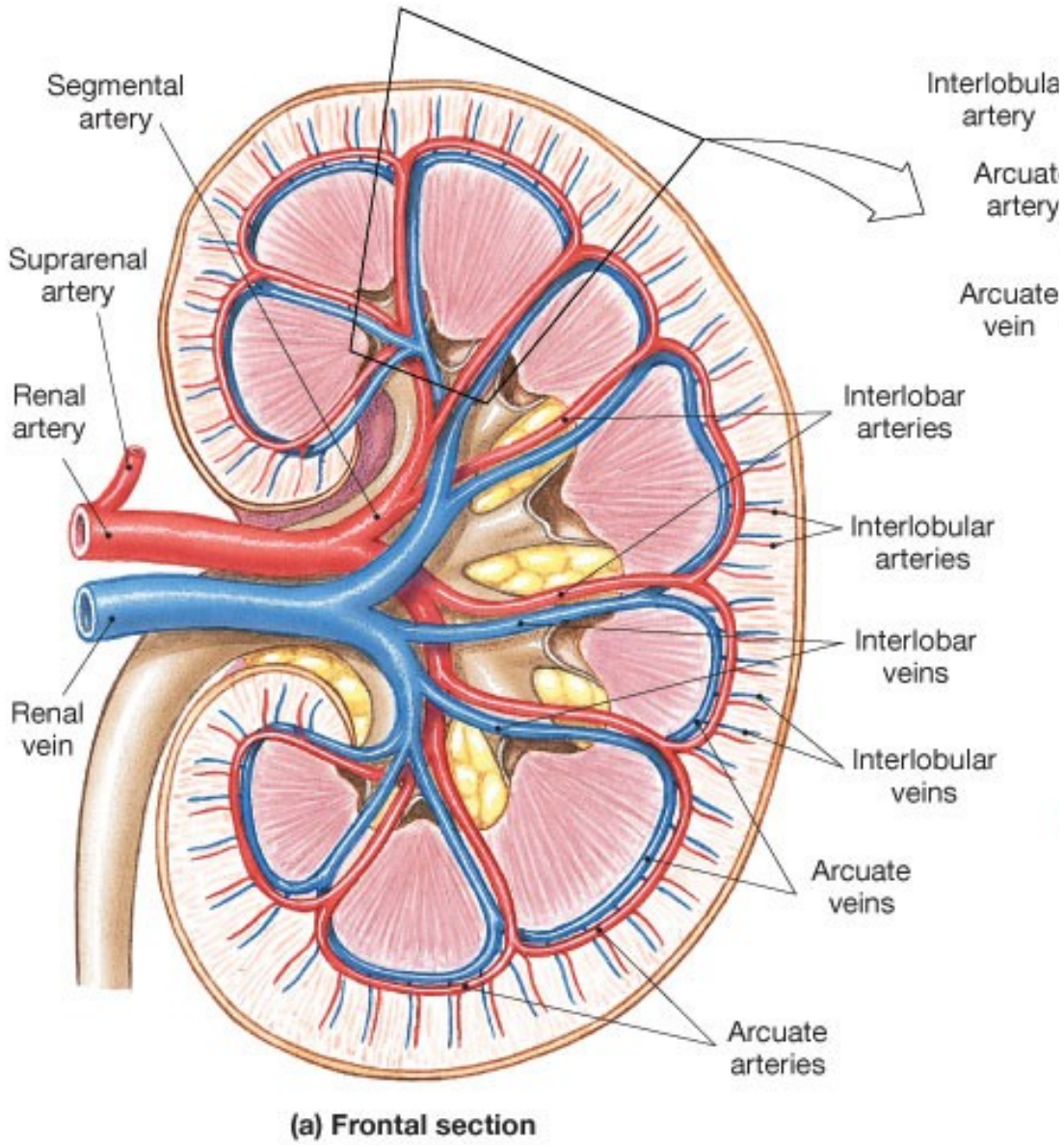
Renal Blood Supply



Renal a.

↓

Segmental a.

↓

Interlobar a.

↓

Arcuate a.

↓

Cortical radiate a.

↓

Afferent arteriole

- Blood arrives at afferent arteriole.

Filtrate is “filtered” at Glomerulus.

(a fenestrated capillary bed)

- Blood departs via efferent arteriole.

a) Peritubular capillaries (cortical nephrons)

or

b) Vasa recta capillaries (juxtamedullary nephrons)

Veunles

Venules

Interlobular v.

Arcuate v.

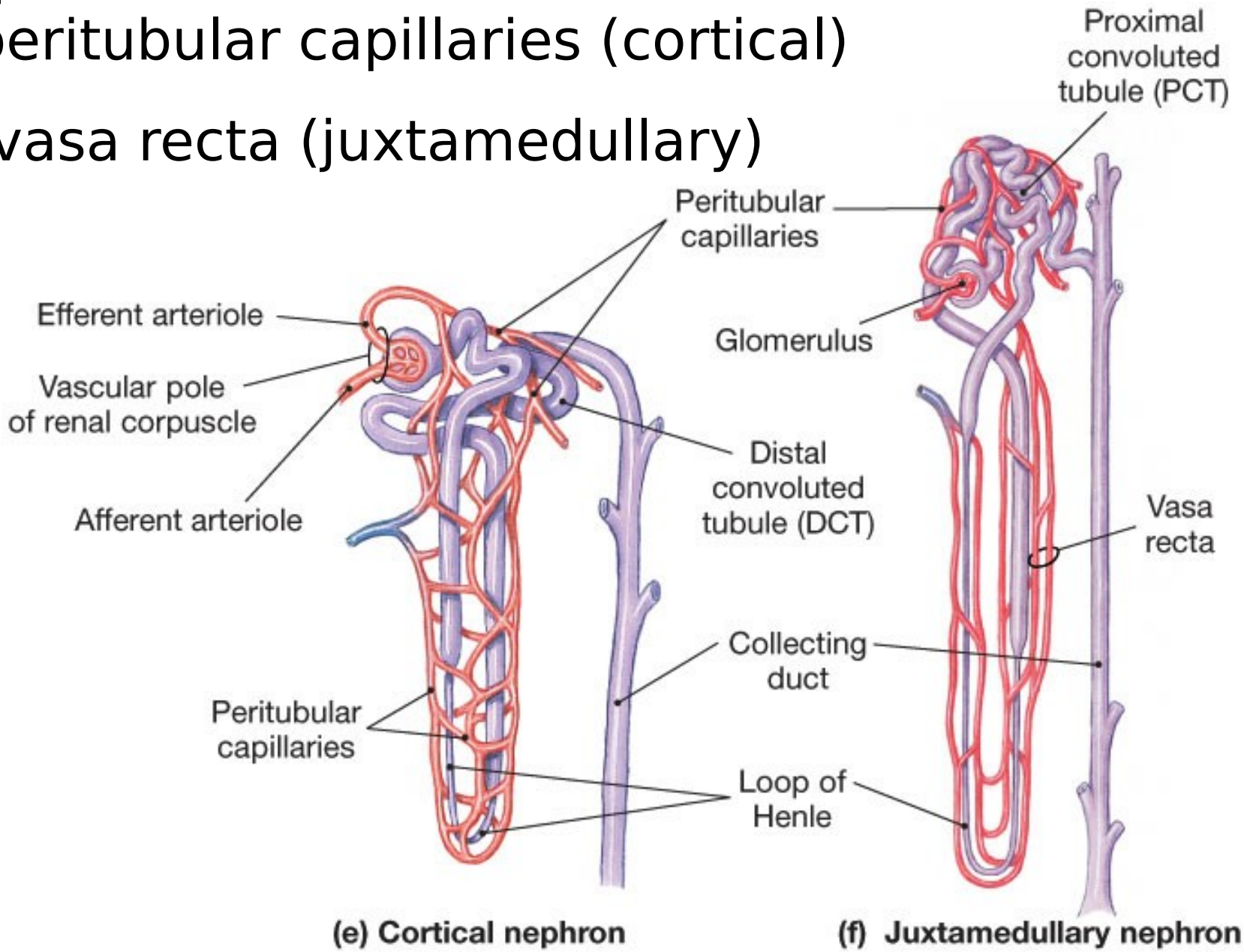
Interlobar v.

Renal v.

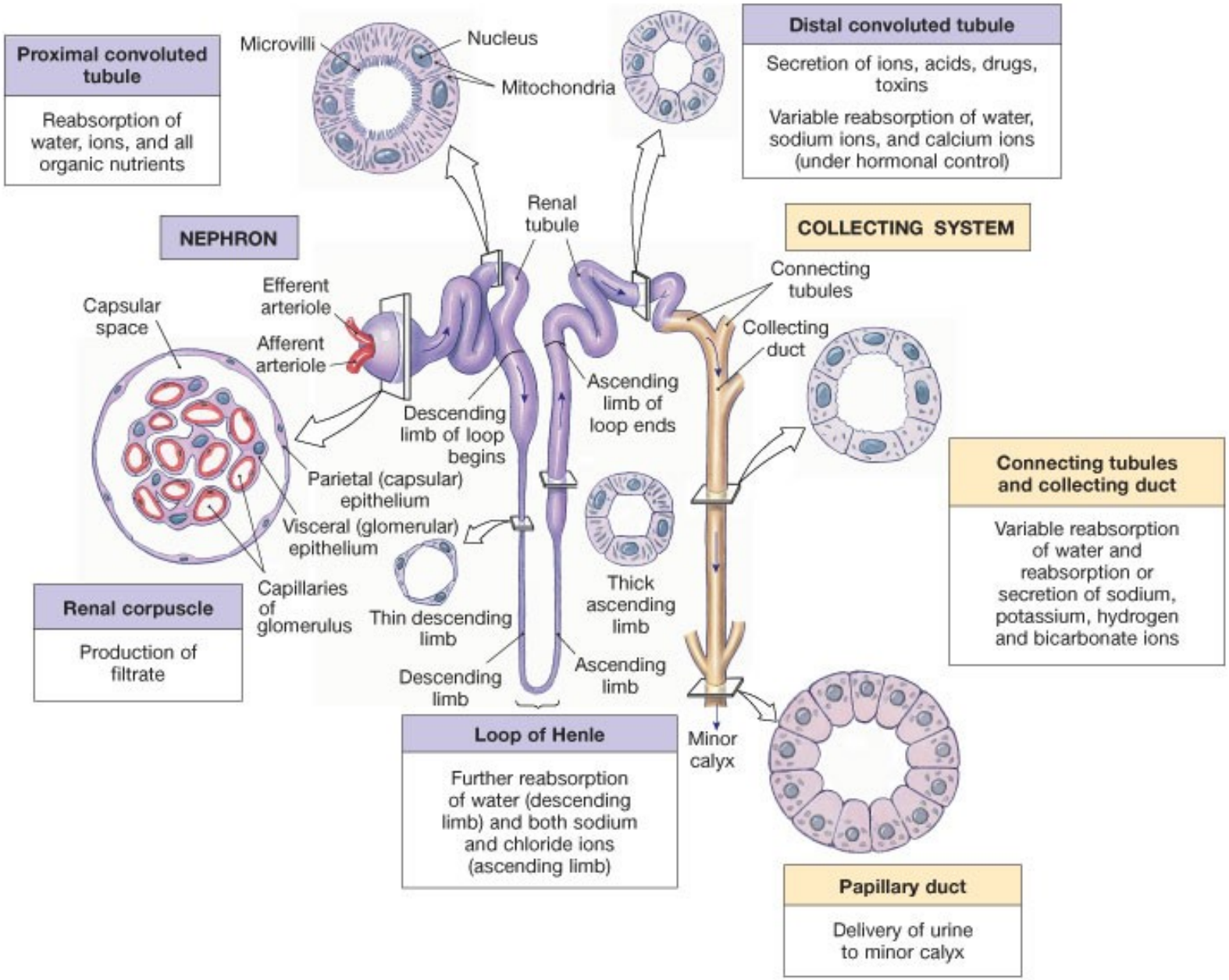
lephrons with:

)peritubular capillaries (cortical)

) vasa recta (juxtamedullary)

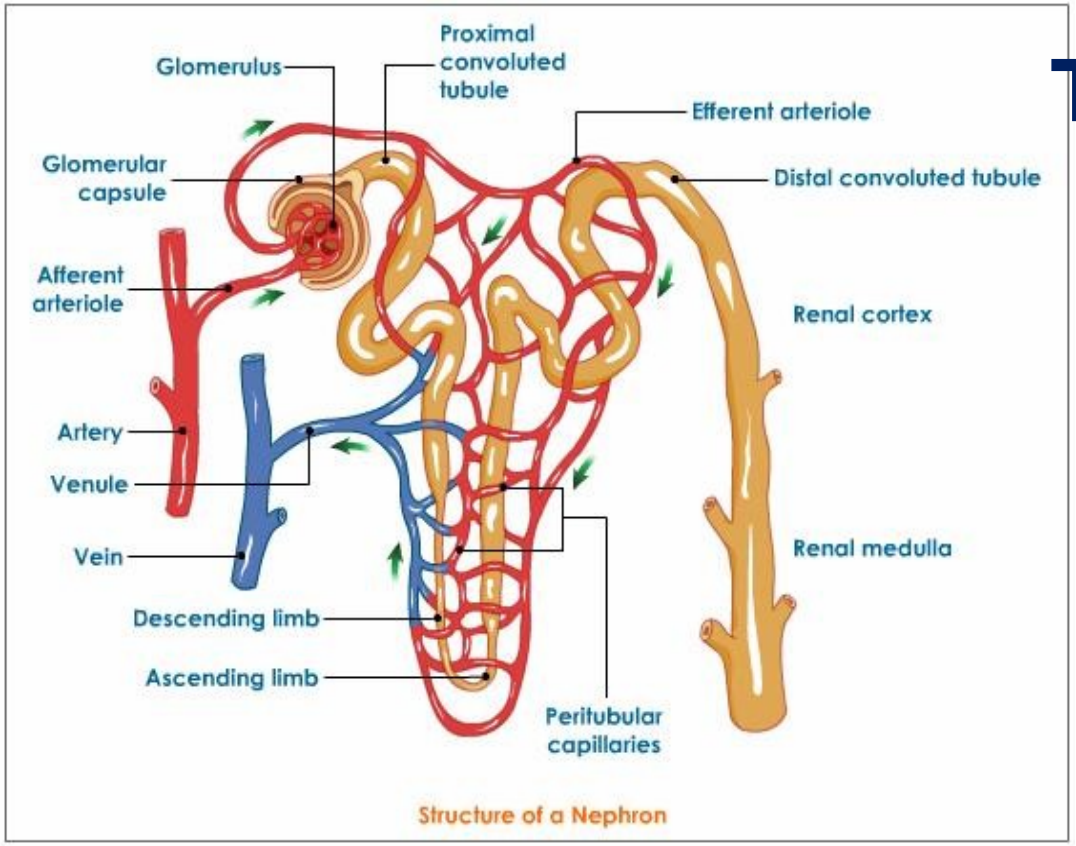


The Renal Tubules



The Renal Tubules

a) Proximal Convoluted Tubule



- Actively reabsorbs most of filtrate
  - Nutrients (glucose, amino acids)
  - Ions (Na^+, Ca^{2+}, etc.)
- Simple cuboidal epi

  With microvilli (brush border) = large surface area

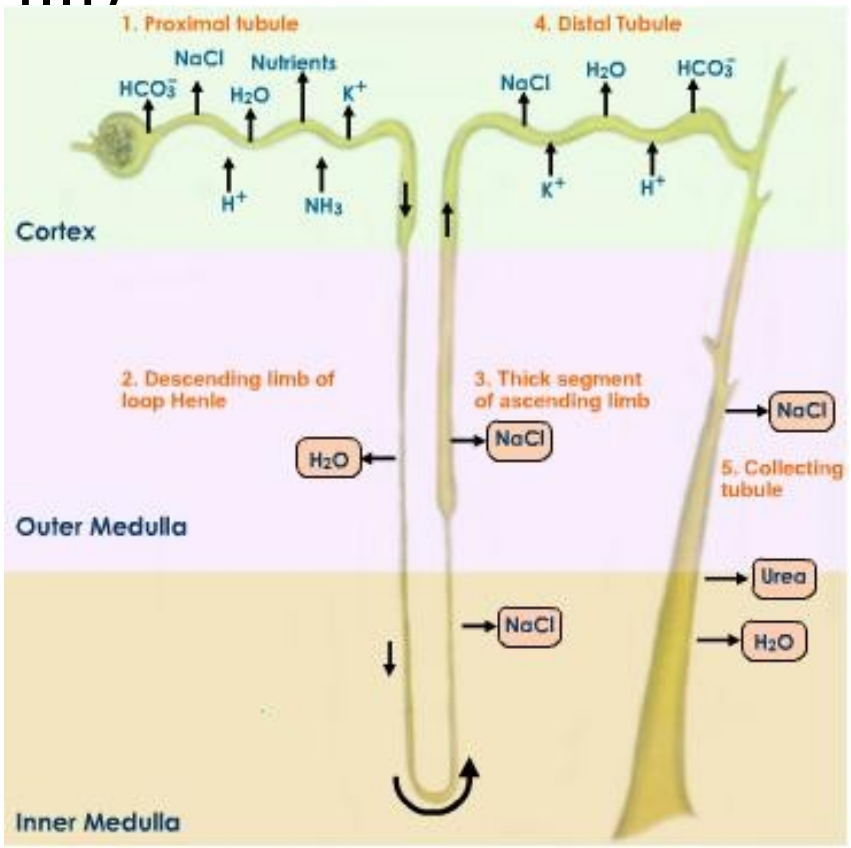
b) Loop of Henle

Descending and Ascending limb

- For Water balance

Thin segment - simple squamous epi.

Thick segment - simple cuboidal epi (no microvilli)

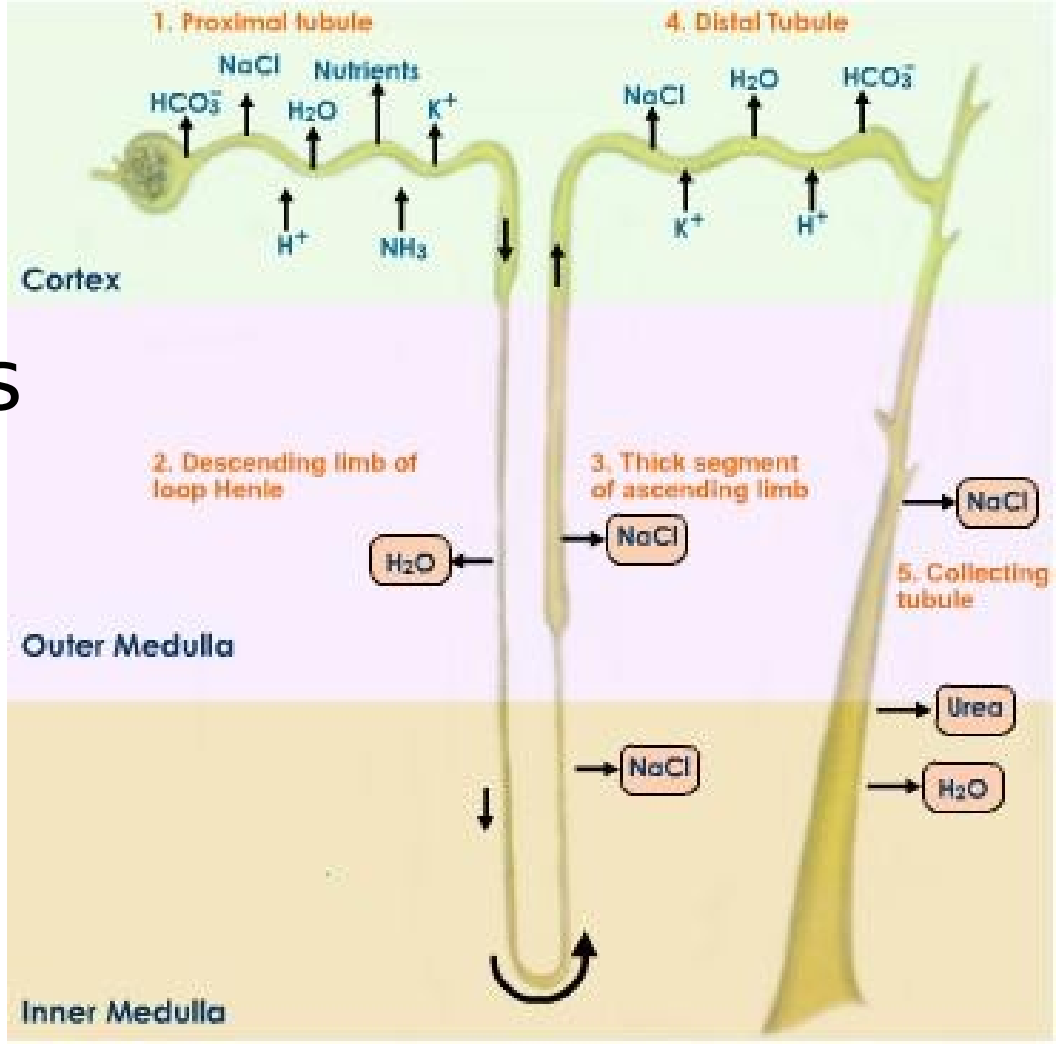


c) Distal Convoluted Tubule

Actively secretes ions

and other materials

Lined with simple cuboidal epi.

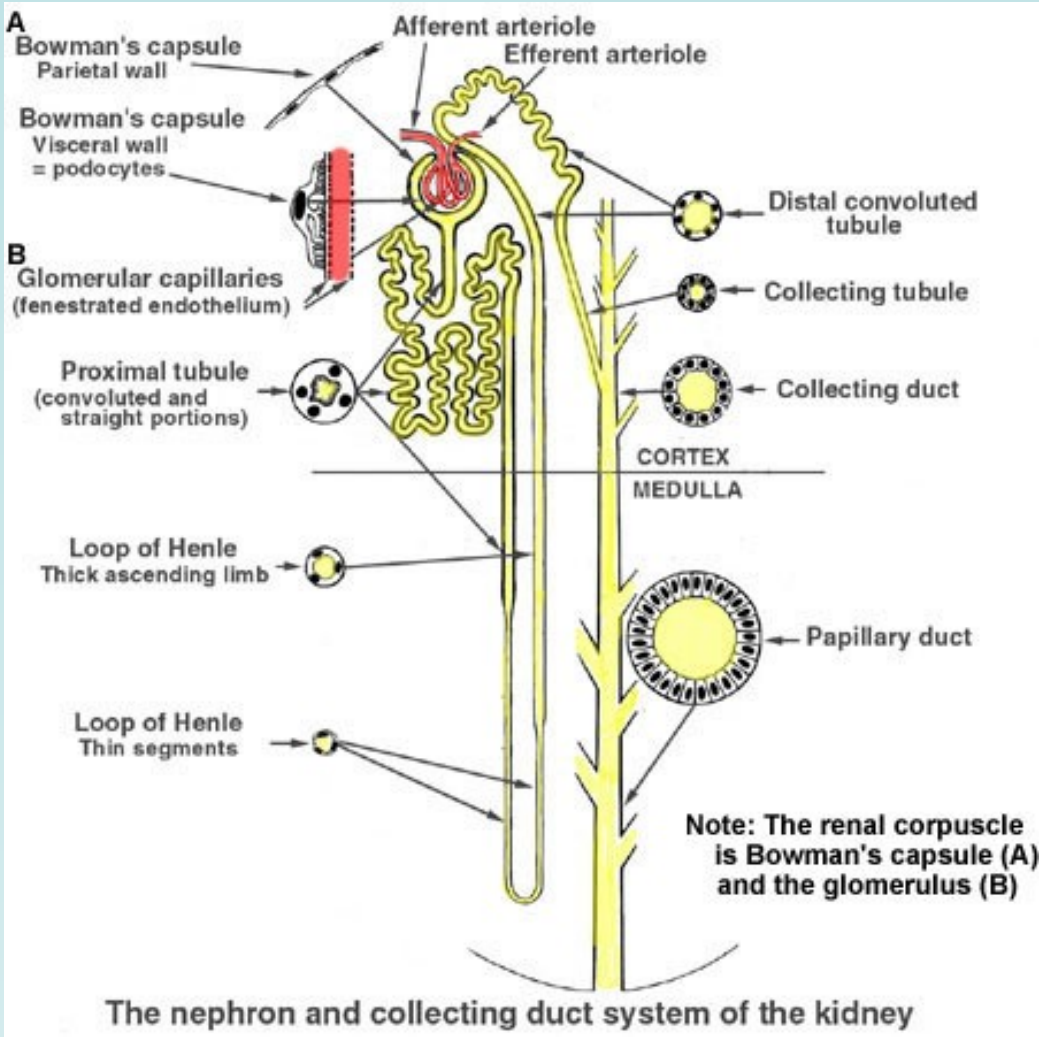


Collecting Duct - simple cuboidal epi.

Changes to simple columnar epithelium

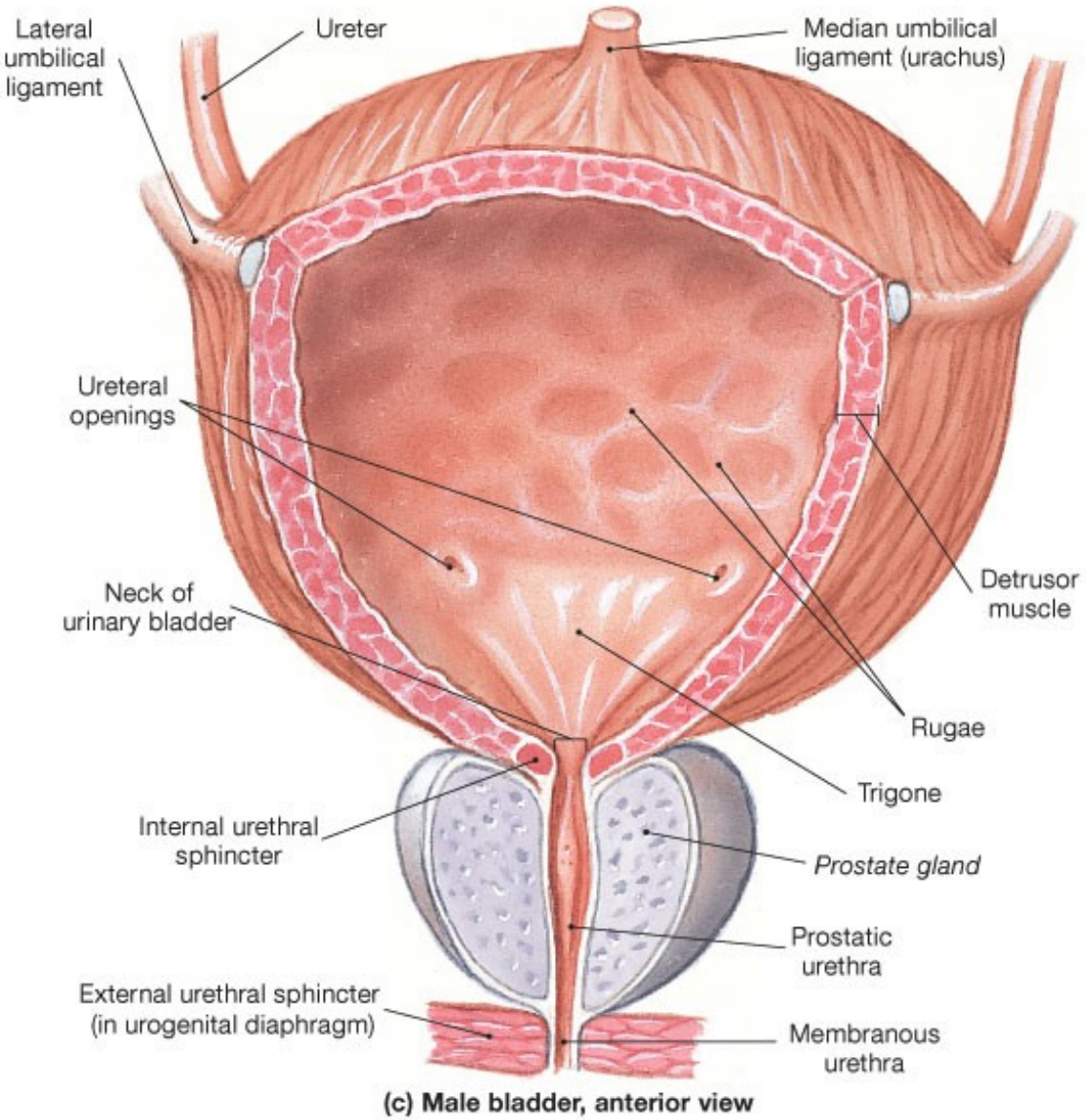
deeper in medulla.

AntiDiuretic Hormone (ADH) acts here to conserves H_2O

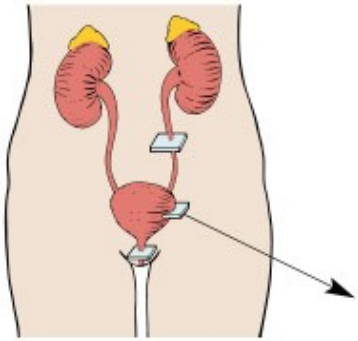


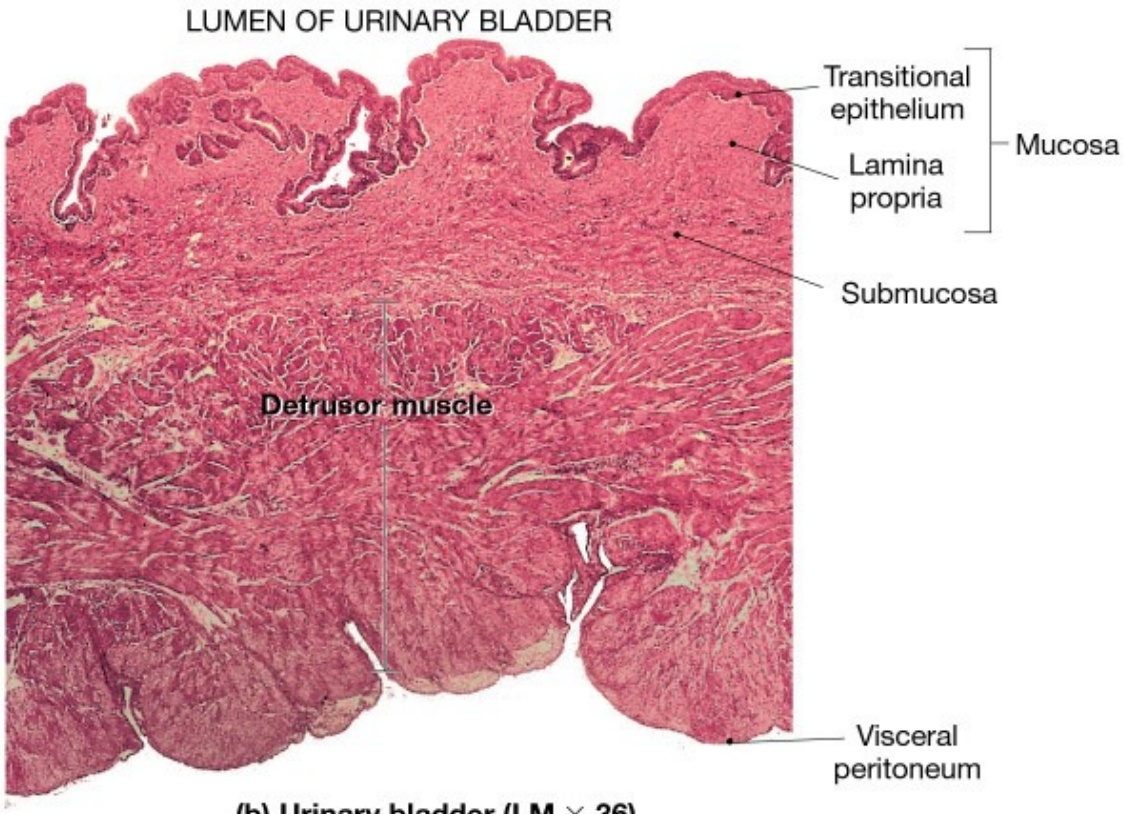
The nephron and collecting duct system of the kidney

Bladder is lined with . . .Transitional epithelium



(c) Male bladder, anterior view





(b) Urinary bladder (LM × 36)

There are 4 Processes in the kidneys:

1. **Filtration:** at Glomerulus – net movement of substances from glomerulus to Bowman's space.

2. **Resabsorption:** – net movement of substances from renal tubules and collecting duct into peritubular & vasa recta capillaries.

3. **Secretion:** – net movement of substances from peritubular & vasa recta capillaries into renal tubules.

4. **Excretion:** – elimination of urine from body.